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NEW NORTH AMERICAN SPECIES OF EARTHWORMS OF THE FAMILY MEGASCOLECIDAE

By Frank Smith
Professor Emeritus, University of Illinois

Among the more interesting specimens of Oligochaeta in the collections of the writer are some that were taken in Oregon and that belong to new species of the genera *Megascolides* McCoy and *Plutellus* E. Perrier. Only one North American species of *Megascolides* and only a few of *Plutellus*, chiefly from California, have been described.

SOURCE OF MATERIAL

A brief description of *Megascolides americanus* Smith was published by the writer in 1897, but it was necessarily incomplete because the only available material for study consisted of four specimens that had been collected at a time of sexual inactivity when the reproductive organs were not well developed. The specimens were received from R. W. Doane, of the Washington State Agricultural College at Pullman, Wash. No other material has since been available for study until 1931, when five specimens were received from Roy Hansberry, of the same institution. They were collected by Dr. Arthur Svihla on March 21, 1931, again at a time when the reproductive organs were not at the height of activity. Later in the same year a specimen of the same species was received for identification that had been collected at Moscow, Idaho, a few miles east of Pullman. A study of this material recently received, together with a further study of the original specimens, has brought to light additional data.

Descriptions of the new species of *Megascolides* in this paper are based on material received from different parts of Oregon. F. M. McElfresh, of Salem, Oreg., in the autumn of 1899 sent a single specimen, collected in the Cascade Range, that belongs to an undescribed species of this genus. No data concerning the exact location and date of collection are available. In January 1903, Mr. McElfresh sent a specimen that had been collected at or near Salem, and it was found to belong to another species of *Megascolides*. These two specimens and two others belonging to a new subspecies of *Plutellus* were carefully studied as the basis for a thesis in partial fulfillment of the requirements for the degree of master of arts in zoology in the Graduate School of the University of Illinois in 1917 by Lola E. Swift (Faust) under the supervision of the writer. The results of this study have not had formal publication and have been utilized in part herein. In February and March 1931, F. E. Garlough, director of the Control Methods Research Laboratory of the United States Biological Survey at Denver, Colo., sent material that included collections made in Oregon at Netarts, near the Pacific coast, and at Multnomah in the northern interior part of the State. These collections include specimens of new species of *Megascolides* and *Plutellus*.

The material from these various sources has supplied data for the description of the following new species and subspecies: *Megascolides cascadensis*, *M. macelfreshi*, *M. michaelseni*, *M. eiseni*, *Plutellus garloughi*, *P. oregonensis*, *P. o. swiftae*.

Two of the new species of *Megascolides* are based on but a single specimen of each, and these were collected at a time when the reproductive organs were not fully developed. When these specimens were prepared for examination, lack of experience in studying such animals resulted in a lack of the best mode of their preparation for such study and hence in less adequate data than would be desirable. The differences between these individuals and those of other kinds studied are sufficiently great to convince the writer that they must belong to distinct species, and they have been so treated, in spite of the desirability of having a larger number of specimens and more adequate data. It is hoped that more extensive collections from various parts of Oregon and adjacent States may be made and studied, for still other new species of Megascolecidae probably may be found in that region.

TERMINOLOGY

Before presenting details of anatomy in the descriptions, it seems desirable to refer briefly to the terminology used. There is much diversity in the terms used by different writers in describing the

various organs in Oligochaeta and not infrequently in those used at different times by the same writer. In describing the reproductive organs the writer prefers the terms spermaries and ovaries, respectively, for the male and female gonads and also the terms sperm ducts and oviducts for the ducts through which the germ cells pass on their way outward. The terms sperm sacs and ovisacs are used for the chambers that are formed by evagination of septa of the gonad somites and that provide space in which the germ cells may pass through a part of their development. The term spermathecae is used for the chambers having openings on the outer surface of the body wall and that store the sperm cells received from some other individual. The term prostates is used for certain organs associated with the male reproductive organs of some kinds of earthworms, including those described in this paper. The terms spermathecal ducts and prostate ducts are applied to the ducts through which the cavities of the spermathecae and prostates, respectively, are in communication with the exterior.

The openings of the various ducts at the body surface are termed pores, and there are spermiducal pores, oviducal pores, spermathecal pores, and prostatic pores. Because of the fact that in some kinds of earthworms, including those described in this paper, the sperm ducts open into the cavities of the prostate glands or ducts instead of at the body surface, thereby making but one pair of surface pores for these two or three pairs of organs, there is chance for confusion if either of the terms spermiducal pores or prostatic pores is used in the description of such species. The term male pores seems to the writer to be preferable and is used in the descriptions herein for openings that are outlets for both prostate ducts and sperm ducts that have united before reaching the surface.

In some groups of earthworms, including many of the Megascolecidae, there is present a longitudinal blood vessel in close relation with the median dorsal surface of the alimentary tract of a few of the somites of the posterior half of the esophagus and lying between it and the dorsal vessel. The term supraintestinal is commonly used for this vessel, even though it is connected with the esophagus instead of the intestine. Another term sometimes used is supra-esophageal, which seems preferable and is used in the descriptions herein.

The term "hearts" is often applied to certain contractile commissural vessels connecting the dorsal and ventral vessels. In some kinds of earthworms some of these hearts have their dorsal connection with only the dorsal vessel and are called dorsal hearts, while some of the posterior ones may have connections with both the dorsal and supra-esophageal vessels and are termed dorso-esophageal hearts. In the species of *Megascolides* here described the supra-esophageal vessel is not so definitely separated from the dorsal part of the vascu-

lar plexus of the esophagus as it is in many species, and the major dorsal openings of the more posterior hearts are more directly connected with the plexus, but the term dorso-esophageal hearts seems just as appropriate and is used.

Calciferous gland is a term applied to a kind of glandular development found in the wall of certain parts of the esophagus of some kinds of earthworms, including the Lumbricidae, *Diplocardia*, and some others. Similar organs are found in the species of *Megascolides* and *Plutellus* here described. In such worms there may be one or more pairs of lateral enlargements within which the epithelial lining of the lumen has numerous diverticula, folds, or even lamellae with an abundant supply of branches of the circulatory system. In some cases, especially among the Lumbricidae, small particles of calcium carbonate appear in abundance in such glands. In the Lumbricidae these glands are usually located in somites 10–14. In *Diplocardia* they are found in somites 14–15, and in the different species of that genus there is a notable diversity in the extent of their development. In some species the folds are not very high or very numerous, while in certain other species they are more numerous and crowded and attain a complexity similar to that found in the Lumbricidae. A similar variability in complexity is found in species of *Megascolides* and *Plutellus* described in this paper. In these species the calciferous glands are located in somites 9, 10, or 11 to 14, 15, or 16.

Nephridia are lacking in a very few somites at the anterior and posterior ends of worms belonging to *Megascolides*, as they are in other kinds of North American earthworms, but instead of the other somites having but one pair to each somite there are several times as many nephridia to each somite in the species of *Megascolides*. The nephridia in the anterior part of the body are all very small and are known as micronephridia. In the posterior region each somite with nephridia has several micronephridia and also a single pair of larger ones termed meganephridia.

Genus MEGASCOLIDES McCoy

Megascolides McCoy, Prodromus of the zoology of Victoria, vol. 1, decade 1, p. 21, 1878.

The discovery of a species of *Megascolides* in North America in 1896 was of considerable interest because of the fact that other species of the genus had been found only in the region of Australia, southeastern Asia, and neighboring areas. The discovery of several additional species in a limited region in North America, all of them different from the known Old World species, naturally leads to the assumption that the first appearance of representatives of the genus in North America may have been at a time sufficiently long past to have allowed the differentiation of new species since.

Important characters of the genus *Megascolides* as given by Stephenson (1930, p. 835) are: "Setae eight per segment. Spermathecal pores one to five pairs, the last in furrow 7/8 or 8/9 or on segment ix. One gizzard in the region of segments v and vi. Micronephridial at least in the anterior part of the body, often throughout. Prostates tubular, with simple unbranched canal." Equally important are certain other characters found also in some other genera of the subfamily Megascolecinae. Each of the ducts of the one pair of prostate glands is united with the sperm duct or ducts of the same side of the worm, and they open in common on somite 18.

MEGASCOLIDES AMERICANUS Smith

Megascolides americanus SMITH, Amer. Nat., vol. 31, p. 203, 1897.

Distinguishing characters.—Length of fairly well extended specimens, 180–190 mm. Diameter, 6–7 mm. Number of somites in eight specimens averaged 235. Setal distances in anterior part, approximately $aa:ab:bc:cd=10:2:8:4$; and posterior to the clitellum $aa:ab:bc:cd=12:3:7:4$; *dd* in the anterior part is about two-thirds of the circumference and posteriorly is but little more than one-half of the circumference. Penial setae on 18, very closely paired, long, slender, curved in sagittal plane, with distal one-third projecting posteriad from openings, and finely sculptured near tips. The clitellum includes 13–22 and part of 23; incomplete ventrally; reddish tan color. Circular, median, ventral papillae on 14/15, 15/16, and 16/17; paired ventral papillae on 19/20, 20/21, and in some specimens on 21/22. A pair of prominent transversely elongate papillae on 18, bearing penial setae and male pores. Spermathecal pores on 7/8 and 8/9.

Septa 7/8–11/12 are strongly thickened, 6/7 and 12/13 less thickened. Calciferous gland in 11–15 and less definitely developed than in some species. The two sperm ducts of either side unite in 16, and the common duct thus formed opens into the proximal part of the prostate duct of the same side. Spermathecae paired in 8 and 9.

External characters.—Presumably owing to differences in treatment when they were preserved, the four specimens collected in 1896 at Pullman, Wash., were less contracted than were the five specimens collected there in 1931. In some specimens in each collection the diameter in the region of 18 is not much more than one-half as great as that near 8 and 30, where the diameter is at a maximum. The average length of specimens in the earlier collection is 180–190 mm and the maximum diameters 6–7 mm; while the length of those in the later collection is 150–160 mm and the maximum diameters 8–10 mm. One specimen in the earlier collection was ap-

parently incomplete and has but 190 somites; the average number in the other eight specimens of the two collections is 235 somites, with extremes of 218 and 246.

The setae are relatively small and inconspicuous. Anterior to the clitellum only a few of the setae are visible superficially, and one-half or more of them are lacking, although the setae sacs are present in normal number and arrangement. A similar condition exists in some other species described in this paper. In some specimens penial setae are present. Those in the paratype are about 1.5 mm in length, 0.027 mm in diameter throughout most of the length, curved in a nearly sagittal plane with the convex side of the curve anteriad, and with slightly more than one-third of the length protruding from the body and directed posteriad. The sculpture is very fine and noticeable on only the distal portion. The prostomium is prolobic. The first five or six somites are biannulate or partially triannulate, and the others are definitely triannulate. The clitellum includes somites 13–22 and part of 23 and is incomplete ventrally. Its color is reddish tan and is more obvious in specimens having best developed reproductive organs. Elsewhere the preserved specimens lack pigmentation. Circular, median, ventral papillae are present on most specimens on 14/15, 15/16, and 16/17, and there are paired ventral papillae on 19/20 and 20/21. One specimen had an additional pair on 21/22, and another specimen had a papilla on one side of 21/22. A pair of prominent transversely elongate papillae on 18 bear the male pores and closely associated penial setae.

Dorsal pores are present in somites posterior to the clitellum. Nephridiopores are very small and several on each side of most somites. The male pores on 18 are slightly laterad of the penial setae and very close to them. The pair of oviducal pores on 14 are anterior to setae *a* and slightly mesad of them. Spermathecal pores are paired at the anterior margins of 8 and 9 and between seta lines *a* and *b*.

Internal characters.—The septa 7/8–11/12 are strongly thickened, those of 6/7 and 12/13 are somewhat less thickened, and 5/6 and those posterior to 13 are of normal thickness. The pharynx has a thick dorsal wall, and a powerful gizzard is present in 5. The inner lining of the esophageal wall of 6–10 has a few rather prominent folds, which are mostly longitudinal. In 11–15 the esophagus is somewhat dilated between the constrictions caused by the septa. The enlargements in 12–14 are most pronounced, the maximum horizontal diameter being about one-third of that of the body. The inner surface is very irregular, owing to the presence of numerous elongate diverticula of which many extend nearly to the middle of the lumen and some are more or less flattened. These diverticula are very variable in length, width, and direction, and some of them are

branched. The blood plexus of the middle layer of the esophageal wall has branches extending into many of the diverticula. It seems probable that the function of this part of the alimentary tract is similar to that of the organs known as calciferous glands in some kinds of earthworms, and, since in some closely related species described in this paper this part of the esophagus becomes more highly modified into a definite calciferous gland, it seems advisable to apply the same term to this part of the esophagus in the present species. The intestine begins in 19 but does not attain maximum enlargement anterior to 21. A typhlosole is present but is not large.

The study of the circulatory system has added to the facts given in the preliminary report (Smith, 1897) but does not provide material for a complete description. A dorsal vessel and ventral vessel are present as in other earthworms. No lateral neural or subneural vessels were found, a condition commonly reported in Megascolecidae. Because of incompleteness in the series of sections available, the anterior and posterior extremities of the supra-esophageal vessel were not located. Enlargements of the vessel and communications with the plexus of the esophagus are present in 9–14. The parts of the vessel that connect these enlargements and pass through the septa are inconspicuous. Paired dorso-esophageal hearts are present in 10–13, where their chief dorsal communication is with the supra-esophageal vessel. In each of somites 7–9 is a pair of smaller dorsal hearts. The micronephridia in the specimens examined seemed to be present in somites beginning with the second one, and the number is somewhat variable, but there are approximately seven on each side of the somites. There is also a pair of meganephridia in each of the somites in the posterior part of the worm.

The reproductive organs are similar to those commonly found in the genus. Spermaries and spermiducal funnels are paired in each of somites 10 and 11 and the sperm ducts of either side unite in 16, and the common duct thus formed opens into the proximal end of the prostate duct of the same side. Paired sperm sacs in 11 and 12 open through septa 10/11 and 11/12 into the cavities of 10 and 11, respectively. The openings are near the lateroventral esophageal wall. One pair of tubular prostate glands is present in 18. The glandular part of each is long, tubular, and contorted and occupies considerable space. Each prostate duct has a length about equal to a half of the diameter of the worm and is an outlet not only for gland secretions but also for sperm cells. Ovaries and oviducal funnels are paired in 13 and oviducts in 14. There is a pair of spermathecae in each of somites 8 and 9. In the sexually inactive specimens available for study the spermathecal ducts are very short, and each has on the anterior lateral wall a diverticulum with thick irregular walls.

The ampulla of each spermatheca is of nearly spherical form and has relatively thick walls with irregular folds present in the interior surface. These folds are more prominent on the part of the wall nearest the median longitudinal axis of the worm.

MEGASCOLIDES CASCADENSIS, new species

Distinguishing characters.—Length of preserved specimen, 185 mm. Diameter, 5–7 mm. Somites, about 265. Setal distances, approximately *aa: ab: bc: cd*=14:3:8:6; *dd* in anterior region about two-thirds of circumference and in posterior region about one-half of circumference. Penial setae, two pairs on 18, more than 1.5 mm long; 0.035–0.04 mm in diameter; each has a rather abrupt curve near the outer end and very minute sculpturing; the remaining part is nearly straight. The clitellum includes 13–20 and is incomplete ventrally. Paired ventral papillae on 15/16, 16/17, 19/20, and 20/21. Spermathecal pores on 7/8 and 8/9. Septa 6/7–11/12 most strongly thickened. Calciferous gland with irregular diverticula extending into the lumen in 10–15, reaching two-thirds of the distance to the middle of the lumen in thirteenth somite and less in others. Sperm ducts enter separately into prostate gland at the beginning of the prostate duct. Spermathecae paired in 8 and 9.

Material.—The only material available is an alcoholic specimen, the holotype (U.S.N.M. no. 20243), received from F. M. McElfresh of Salem, Oreg., in the autumn of 1899 with the statement that it was collected in the Cascade Range in Oregon and with no other data. Soon after the specimen was received transverse sections were made of a piece including the lateral half of somites from the middle of 14 to the middle of 19 as indicated by external characters, but the internal parts were displaced somewhat posteriad, and the sections included the alimentary tract and parts of the circulatory system of the posterior part of the thirteenth somite. Transverse and sagittal sections were also made of pieces near the posterior end. More recently the anterior part of the specimen was split in the median sagittal plane. A study of these parts and sections, and of the external characters of the remainder of the specimen, has supplied data for the following description, which, though far from complete, seems sufficient to warrant the recognition of a species distinct from those previously described.

External characters.—The length is 185 mm, and the maximum diameter anterior to the clitellum is 7 mm and posterior to the clitellum 5–6 mm. In the middle of the clitellar region the diameter is somewhat less than in adjacent parts. The number of somites is about 265. Somites posterior to 5 are triannulate. The setae are small and inconspicuous, with a length less than the thickness of the body wall, and some are lacking. The setal distances both

anteriorly and posteriorly are approximately *aa*:*ab*:*bc*:*cd*= 14:3:8:6; *dd* anteriorly is nearly two-thirds of the circumference and posteriorly only about one-half of it. The penial setae are very closely approximated on each side of 18 and also very close to the male pores, which are slightly laterad of *b*. The sectioned penial setae were in fragments, but the length is evidently more than 1.5 mm and the diameter 0.035–0.04 mm. There is an abrupt curve near the distal end, but elsewhere the setae were apparently nearly straight. The terminal parts are minutely sculptured. The clitellum is incomplete ventrally and includes 13–20. Paired ventral papillae are present on 15/16, 16/17, 19/20, and 20/21.

Dorsal pores are present posterior to the clitellum. Nephridiopores are very inconspicuous and situated near the anterior margins of the somites. The male pores are paired on 18 slightly laterad of seta line *b*, and the protruding penial setae are in paired depressions of the ventral surface. Oviducal pores are paired on 14. Spermathecal pores paired on 7/8 and 8/9 in seta line *b*.

Internal characters.—Septa 6/7–11/12 are most thickened. A lack of sections of the anterior dozen somites accounts for a lack of details concerning some of the organs of those somites. A thick-walled pharynx is followed by a powerful gizzard in 5. The sectioned part of the esophagus posterior to the middle of 13 has the type of structure termed calciferous gland but is of the simpler type such as is found in *M. americanus*. The lining layer of the lumen forms numerous irregularly arranged elongate diverticula, which are of variable length, and many extend nearly two-thirds of the way to the middle of the lumen. They receive an abundant blood supply from the vascular plexus in the esophageal wall. An examination of the alimentary tract in the unsectioned region reveals a gradual increase in diameter and in the number and length of the diverticula in 10–13. The differentiation of this part of the esophagus as a calciferous gland is even less than that found in *M. americanus*. In 16 and 17 the lining layer forms longitudinal folds not extending far into the lumen. The folds become fewer in number in the following somites, and then the enlarged intestinal tract begins at about the twentieth somite. A definite typhlosole is present.

The circulatory system has not been thoroughly studied but seems similar in essentials to that in the other species here described. Three pairs of smaller hearts are present in 7–9, and four pairs of larger hearts are present in 10–13. The pair in 13 are the only ones of which sections were made, and they are of the dorso-esophageal type, opening into the ventral vessel below, and dorsally each of them has a small branch that opens into the dorsal vessel and a larger one opening directly into the esophageal vascular plexus. It seems probable

that the hearts of 10–12 have similar relations. In the sectioned part a distinct supra-esophageal vessel is present for only very short distances where the esophagus passes through the septa 13/14 and 14/15. The status of the supra-esophageal vessel anterior to 13 has not yet been determined. It seems to end posteriorly in somite 15. The nephridial system is of the micronephric type, with six or seven micronephridia on each side of anterior somites and about four micronephridia and one meganephridium on each side of posterior somites.

A pair of spermaries and of spermiducal funnels is present in each of somites 10 and 11, and the two sperm ducts of either side extend posteriorly closely parallel and between the epithelium and muscle layer of the body wall until they reach 18, where they leave the body wall and enter the prostate gland at the beginning of the prostate duct. They do not unite before reaching the lumen. A pair of ovaries and of oviducal funnels is present in 13. A pair of spermathecae is present in each of somites 8 and 9, and the duct of each is short; no diverticula were noticed.

MEGASCOLIDES MACELFRESHI, new species

Distinguishing characters.—Length of preserved specimen, 155 mm. Diameter, 7–8 mm. Somites, 282. Setal distances, approximately $aa:ab:bc:cd=6:2:3:3$; *dd* is slightly more than one-half of the circumference. Penial setae nearly straight, with distal end rather abruptly curved and tapering; length probably not over 1 mm and diameter less than 0.04 mm. Clitellum 13–21 and incomplete ventrally. Paired ventral papillae on 14/15–16/17 and 19/20. Oviducal pores on transverse elevation on 14 and nearer to seta line *a* than to median line. Spermathecal pores on 7/8 and 8/9. Calciferous gland in 10–15 with numerous diverticula but of simpler type. Sperm ducts in close contact when they enter the prostate gland very near its union with the prostate duct and then seemingly unite before opening into the lumen of the gland. Spermathecae paired in 8 and 9.

Material.—The only specimen available for study is the holotype (U.S.N.M. no. 20244), which was received in living condition from F. M. McElfresh, of Salem, Oreg., in January 1903. The anterior 22 somites were split in the median sagittal plane, and transverse sections were made of the part of one-half that included the posterior part of 16 to the posterior part of 22. Transverse and sagittal sections were made from parts near the posterior end to provide material for a study of the nephridia. The sections were prepared soon after the specimen was received and before the writer realized the desirability of a study of the calciferous gland region and of certain parts of the circulatory and reproductive systems.

External characters.—The color of the living specimen was a pale flesh tint, more pronounced on the 10 anterior somites. The clitellum was fleshy orange in color. The length when fully relaxed was about 300 mm, but the preserved specimen has a length of 155 mm. Diameter, 7–8 mm. Number of somites, 282. Prostomium small and apparently prolobic. The setae are relatively small and widely spaced; approximately $aa:ab:bc:cd=6:2:3:3$. In the posterior region *dd* is but little more than one-half of the circumference, while in the anterior region it is nearer two-thirds of the circumference. The length of the setae is variable and commonly 0.4–0.5 mm, with a maximum diameter of about 0.028 mm. The penial seta of the sectioned part is seta *b* of 18, and seta *a* is lacking. There is a partially developed reserve seta in each of the setal sacs *a* and *b*. The length of the fully developed penial setae is probably not more than 1 mm. The maximum diameter is less than 0.04 mm. They are nearly straight throughout the greater part of the length, but the distal part of the protruded portion is rather abruptly curved and tapers. The distal end has very minute sculpturing, difficult to recognize. The male pores and the setal apertures of *a* and *b* are very close together.

The clitellum is incomplete ventrally and includes 13–21. The thickened glandular wall terminates ventrally between seta lines *b* and *c*. Paired ventral papillae are present on 14/15–16/17 and 19/20 in line with the ventral pairs of setae, and small asymmetrically placed ones are present on 20/21 and 21/22. Dorsal pores are present, posterior to the clitellum. Nephridiopores are very inconspicuous and situated near the anterior margins of the somites. The male pores are paired on 18 slightly laterad of seta line *b*. Oviducal pores are paired on the anterior part of 14 nearer to seta line *a* than to the median ventral line and are borne on an elongate transverse elevation. Spermathecal pores are paired on 7/8 and 8/9 in seta line *b*.

Internal characters.—Septa 7/8–10/11 are strongly thickened and 6/7 and 11/12 less strongly thickened. The alimentary tract includes an eversible buccal sac followed by a pharynx with a thick muscular dorsal wall and a gizzard in 5, which is enlarged and forces the septa of 5/6 and 6/7 posteriad. The calciferous gland region in 10–15 is of the simpler type similar to that found in *M. americanus*. There is a gradual increase in diameter and in the number and length of the diverticula from 10 to 13, with maximum development in 14 and 15, where some of them extend nearly two-thirds of the way to the middle of the lumen. In 16 and 17 the lining layer of the esophagus forms longitudinal folds not extending far into the lumen. The enlarged intestinal tract begins at about the 20th somite and has a definite typhlosole. The circulatory system has not been carefully studied, but there are smaller hearts paired

in 7–9, which presumably are dorsal hearts, and larger ones paired in 10–13, which probably are dorso-esophageal hearts. The nephridial system is similar to that of other species of *Megascolides* and is micronephric in the anterior region, and in the posterior region, in addition to five or six micronephridia on each side of each of most somites, there is a pair of meganephridia in each somite.

A pair of spermaries and of spermiducal funnels is present in each of somites 10 and 11, and the two sperm ducts of either side are closely parallel and extend posteriad between the muscular layer and epithelium to 18, where they become separated from the body wall, and to the prostate gland, which they enter near its union with the proximal end of the prostate duct. The two sperm ducts seem to unite just before reaching the lumen of the gland. There is a pair of sperm sacs in each of somites 11 and 12. A pair of prostate glands is present in 18 that are long and contorted and occupy much space, displacing the septa of adjacent somites. A pair of ovaries and of oviducal funnels is present in 13. A pair of spermathecae is present in each of somites 8 and 9 which have very short spermathecal ducts and seem to lack visible diverticula.

MEGASCOLIDES MICHAELSENI, new species

Distinguishing characters.—Length of strongly contracted specimens, 95–110 mm. Diameter, 4.5–8 mm. Number of somites in eight specimens averaged 202. Setal distances in anterior part approximately $aa:ab:bc:cd=10:2:7:4$; *dd* about three-fifths of the circumference; penial setae very closely paired, long, slender, nearly straight except near distal end, where there is a rather abrupt curve with the terminal part at nearly a right angle with the main part and directed anteriad. The curved and terminal parts are finely sculptured. Length of each, 2 mm or more; diameter, 0.07 mm or less. The clitellum includes 13–19, is incomplete ventrally, and is slightly tan-colored. Median, ventral, transversely elongate papillae on 11/12, 12/13, 14/15, 15/16, and 16/17. Paired ventral papillae on 19/20 and in most specimens on 20/21. Spermathecal pores on 7/8 and 8/9 in line with setae *ab*.

Septa 6/7–10/11 are strongly thickened and 11/12 and 12/13 less thickened. Calciferous gland in 10–15. The pair of sperm ducts of either side remain separate and unite with the prostate duct very near its proximal end. Spermathecae paired in 8 and 9.

Material.—Ten specimens were collected at Netarts, Oreg., and received in February 1931. The specimen selected as the holotype (U.S.N.M. no. 20245) was split in the median sagittal plane of somites 1–22, and one-half was removed and cut into transverse sections. Transverse and longitudinal sections from two other specimens were also made and studied.

External characters.—When collected the specimens apparently had their length much decreased by strong contraction, with a resulting increase in the diameter. The length of the preserved specimens is probably not much more than half of that which they might sometimes have had when crawling about under normal conditions. The type specimen is about 105 mm long, the maximum diameter is about 8 mm in the region of the eighth somite, and the average diameter is about 6 mm. The average length of eight specimens is 101 mm, with extremes of 95 and 110 mm. The average maximum diameter of the eight specimens is 7.8 mm, and the average of the average diameters is 5.6 mm. The diameter midway of the length of the clitellar region is less than elsewhere and is 4.5 mm in the type, and 4.8 mm is the average in the eight specimens. The number of somites is 202 in the type, and in eight specimens the average number is 200, with extremes of 186 and 217.

The setae of the anterior region are located with difficulty because of their small size. They have a length of about 0.5 mm or less and a diameter of 0.04 mm or less. The surface of the distal part is but slightly sculptured and is nearly as smooth as that of the proximal part. The setae are noticeably lacking in a few anterior somites. In the part of the type specimen that was sectioned the setae *a* were present only in somites 3, 5, and 10; setae *b* in 5, 7, and 10; and setae *c* and *d* were lacking in 1–10. There were somewhat fewer setae lacking in other sectioned specimens. Setal sacs were present in normal positions where setae were lacking. The penial setae (*a* and *b* of 18) are very different in size and form from the ordinary setae. Each of the two pairs is in a depression, and the setae protrude from the wall a distance of 1 mm or more in most specimens. Each of the penial setae examined is somewhat over 2 mm in length and but slightly curved except near the outer end, where there is a decrease in diameter and a rather abrupt curve, with the terminal part at nearly a right angle with the main part and directed anteriad. The terminal part including the strongly curved part has rather fine sculpturing, but the greater part of each seta is smooth-surfaced and approximately 0.07 mm in diameter in the largest specimen and somewhat less in a smaller specimen. The spacing of the setae is somewhat variable and in the anterior part of the worm is approximately $aa:ab:bc:cd=10:2:7:4$; *dd* is about three-fifths of the circumference.

The prostomium is small and prolobic. The first six somites are biannulate or partially triannulate, and the following ones are definitely triannulate. The clitellum includes somites 13–19 and in one specimen encroaches somewhat on 20. It is incomplete on the median ventral surface. In some specimens it is somewhat tan-

colored, but otherwise there is a lack of pigmentation in the preserved specimens studied. Transversely elongate, median, ventral papillae on 11/12, 12/13, and 14/15–16/17 are present in all the specimens. Paired ventral papillae on 19/20 and 20/21 are present on most of the specimens and are lacking on 20/21 in one of them.

Dorsal pores are present posterior to the clitellum. Nephridiopores are very small and situated near the anterior margins of somites, beginning with the second one. The number to the somite is somewhat variable, commonly 7 or 8 on each side. There is one pair of male pores on somite 18, laterad of the penial setae and very close to them. Oviducal pores are paired on 14, slightly anterior to the ventral setae, and mesad of seta line *a*. Spermathecal pores are paired on 7/8 and 8/9 and in line with the setal pairs *ab* of the corresponding sides.

Internal characters.—Septum 5/6 is not thickened; septa 6/7–10/11 are strongly thickened; 11/12 and 12/13 are less thickened and the following ones not thickened. A well-defined buccal cavity and a pharynx are present. The thickened dorsal wall of the pharynx is connected with the body wall by numerous radiating muscular fibers. A powerful gizzard is present in somite 5. The lumen of the esophagus in 6–8, the anterior part of 9 is relatively small, and the lining epithelium forms several longitudinal folds. In the posterior part of 9 the lumen of the esophagus is much enlarged, and the epithelial lining has numerous thin folds reaching nearly to the middle of the lumen. In 10–15 similar and larger pouchlike evaginations with numerous thin folds of the lining layer are formed. They are largest laterally with the diameter of the esophagus about one-half as great as that of the body. The appearance of transverse sections of these enlargements is similar to that of the calciferous glands of Lumbricidae and of some species of *Diplocardia*. There is a lack of longitudinal chambers extending through consecutive somites and also a lack of a secondary lumen produced by a fusion of the inner edges of the folds. The diameter of the esophagus is much reduced where it passes through the septa. In 16–18 the diameter is considerably less than in 15, and there is but little development of folds. Posterior to 18 the alimentary tract is much enlarged and becomes the intestine and a definite typhlosole is present. The circulatory system lacks subneutral and lateroneural vessels. A supra-esophageal vessel is present in the region of the calciferous gland. Paired dorsal hearts are present in 7–9, and much larger dorso-esophageal hearts are paired in 10–13. Micronephridia are present in 2 and following somites, eight to ten on each side of somites 2–4 and seven or eight on each side of other somites that were examined.

Spermaries and spermiducal funnels are paired in 10 and 11. The sperm ducts of either side are not united but are closely parallel until they reach their outlets into the prostate duct very near its proximal end. Paired sperm sacs in 11 and 12 have their openings into 10 and 11, respectively, through the septa 10/11 and 11/12 near the ventrolateral esophageal wall. One pair of tubular prostates is present in 18. The glandular part of each is long and contorted and occupies a relatively large space. The duct of each has muscular walls and serves as an outlet for the gland products and also for the sperm cells, which enter it near the proximal end through the sperm ducts of the same side. Ovaries and oviducal funnels are paired in 13 and oviducts in 14. No ovisacs were recognizable. A pair of spermathecae is present in each of somites 8 and 9. Each spermathecal duct is short and has a thick muscular wall, and the inner lining is irregularly folded. In the anterior wall of each duct there is included a diverticular chamber connected by a small duct with the lumen of the spermathecal duct. The ampulla of each spermatheca has walls that are thinner near the duct, and the lining layer is irregularly folded. In each of three sectioned specimens, the ampullae in 9 are somewhat larger than those of 8, and the part of the wall on the side in contact with the body wall is very thin and without any folds of the lining layer. In a fourth specimen the difference in the thickness and folding of the wall was less pronounced.

MEGASCOLIDES EISENI, new species

Distinguishing characters.—Length of preserved specimens, 115–170 mm. Average of maximum diameters, 6⅔ mm; near middle of clitellum, 4.5 mm. Number of somites, 191–205. Setal distances in anterior part, approximately $aa:ab:bc:cd=20:3:12:5$; in posterior part $aa:ab:bc:cd=12:3:9:5$; *dd* about three-fifths of circumference; penial setae long, nearly uniformly curved in plane transverse to longitudinal axis of the worm; distal end finely sculptured and projecting from body in a ventrolaterad direction; length 1.8 mm and diameter 0.045 mm in most of length. Clitellum incomplete ventrally and includes 13–19 and sometimes a part of 20; slightly tan-colored. Median ventral papillae on either, or both, of 9/10 and 10/11; paired ventral papillae on 16/17 and 19/20–21/22 or 22/23. Male pores on 18 close to penial setae and laterad of them on laterally elongated elevations. Spermathecal pores, but one pair and at anterior margin of 9, near setal line *b*.

Septa 6/7–11/12 strongly thickened, 12/13 less thickened. Calciferous gland in 10–14. The two sperm ducts of either side remain separate and unite with the prostate duct of the same side near its proximal end. Spermathecae, but one pair and in 9.

Material.—Six specimens were collected at Multnomah, Oreg., in February 1931. The specimen selected as the holotype (U.S.N.M. no. 20246) was split in the median sagittal plane of somites 1–21, and one-half was removed and cut into transverse sections, which are the source of most of the data concerning the internal anatomy.

External characters.—The length of the type specimen is 131 mm; the maximum diameter is 7 mm, and the average diameter is approximately 5 mm. The average length of the six specimens is 135 mm, with extremes of 115 and 170 mm. The average of the maximum diameters of the six specimens is about 6.6 mm, and of the average diameters about 4.5 mm. The diameter near the middle of the clitellar regions is somewhat less than that in adjacent regions of the preserved specimens. The number of somites is 202 in the type, and the average number in the six specimens is 198, with extremes of 191 and 205.

The setae are relatively small in the anterior region, usually not over 0.35 mm in length and with a maximum diameter of 0.028 mm. They are minutely sculptured on the distal part. Most of the anterior somites have their full quota of eight setae to the somite. In the anterior region the spacing is approximately $aa:ab:bc:cd=20:3:12:5$, with *dd* about three-fifths of the circumference. Posteriorly it is more nearly $aa:ab:bc:cd=12:3:9:5$, with *dd* but slightly more than one-half of the circumference. The penial setae are long and slender, with a nearly uniform rate of curvature but somewhat increased in the distal region. The curvature is in a plane transverse to the longitudinal axis of the worm, with the convex side mesad. Only a small part of the length is protruded, and this is curved laterad. The distal part is finely sculptured, and the end is relatively blunt. The length is about 1.8 mm, and the diameter is 0.045 mm throughout most of the length. With each penial seta of the type specimen there are closely associated reserve setae, of which one is about full size and others are only partially grown.

The prostomium is small and prolobic. The anterior six somites are biannulate or partially triannulate and the others definitely triannulate. The clitellum includes 13–19 and invades 20 in two specimens. It is incomplete ventrally and in some specimens seems slightly tan-colored. Median ventral papillae are present on 9/10 on each of two specimens, on 9/10 and 10/11 on each of two other specimens including the type, and only on 10/11 on another one. The papilla on 10/11 is the larger. Paired ventral papillae on 16/17 are present in each of the six specimens, and one of them has an additional papilla on the left side of 15/16. On each of most of the specimens there are paired ventral papillae, transversely elongate, on 19/20–22/23, while on the type specimen they are on 19/20–21/22.

Dorsal pores are present posterior to the clitellum. Nephridiopores are very small and inconspicuous near the anterior margins of the second and following somites. They are usually eight or nine in number on each side of the few anterior somites of which sections were studied. There is a pair of male pores on 18, laterad of the penial setae and very near to them. They are borne on elevations that are transversely elongated and are due in part to an increased thickness and development of the musculature of the body wall in that region. Oviducal pores are paired on 14 and are slightly anterior to the ventral setae and midway between seta line *a* and the median ventral line. There is but one pair of spermathecal pores, and they are located at the anterior margin of 9 and near seta line *b*.

Internal characters.—The septa 6/7–11/12 are strongly thickened, 12/13 less thickened, and other septa not thickened. The pharynx has a thick muscular dorsal wall, and a powerful gizzard is present in 5. A calciferous gland is present in 10–14. The enlargements of the esophagus between the septa have numerous folds of the lining layer reaching nearly to the middle of the lumen. These folds are not quite so numerous and crowded as those found in *Megascolides michaelseni*, and the glandular development is intermediate between that found in the gland of that species and that in the gland in *M. americanus*. The intestine begins at about 19. A typhlosole is present. Dorsal, ventral, and supra-esophageal vessels are present and also hearts in 7–13, but owing to the fact that the longitudinal vessels were in part included in the unsectioned part of the worm a complete study has not been made of all the connections of the various hearts with the longitudinal vessels. The data obtained indicate that the relations are like those found in the other species here described. The nephridia are of the micronephridial type, with about eight on each side of somites beginning with the second one. The pores and ducts are very small and difficult to trace even in sections.

Spermaries and spermiducal funnels are paired in 10 and 11. The sperm ducts of either side are not united but continue their courses closely parallel to each other. They reach the wall of the prostate duct near its union with the gland. Here they enter the wall, which they follow until they open into the lumen of the duct at about one-third of the length of the duct from its proximal end. Paired sperm sacs in 11 and 12 open through septa 10/11 and 11/12 into 10 and 11, respectively, in close proximity to the esophagus. One pair of tubular prostate glands is present in 18. The glandular part is long and contorted. Ovaries and oviducal funnels are paired in 13 and oviducts in 14. No ovisacs were recognizable. There is but one pair of spermathecae, and they are of large size in somite 9.

The ducts are short with thick muscular walls and longitudinal folds in the inner lining. A diverticular chamber with irregularly folded lining is buried in the anterior wall of each duct and its cavity is connected with the lumen of the spermathecal duct by a small channel.

A comparison of the data in the foregoing descriptions seems to the writer to justify the recognition of the two new species *M. cascadensis* and *M. macelfreshi*, of each of which only a single specimen is available. The much greater number of somites, the paired papillae of the somites anterior to the clitellum, the much simpler type of calciferous gland development, and the location of the communication of the sperm ducts with the prostate glands would preclude the inclusion of either of them with either of the other new species. They differ from *M. americanus* in having paired papillae anterior to the clitellum, having the sperm ducts of either side remaining separate until they reach the prostate gland, in the character of the penial setae, and in the extent of the clitellum. They differ from each other in the marked difference in the spacing of the setae, which is much greater than one would expect to find between two specimens of the same species. There are also differences of less importance in the lengths of the penial setae and the number of papillae anterior to the clitellum.

Genus PLUTELLUS E. Perrier

Plutellus PERRIER, Arch. Zool. Exp. et Gén., vol. 2, p. 250, 1873.

The majority of the large number of species of the genus *Plutellus* already described are from the Australian region. Although the description of *P. heteroporus*, on which the genus was founded by Perrier in 1873, was based on two specimens collected in Pennsylvania, no other specimens of this species have yet been reported, nor have other species of the genus been found in the eastern part of the United States. Benham (1892) described a species, *P. perrieri*, based on two specimens collected on the Queen Charlotte Islands, British Columbia. Eisen described a genus, *Argilophilus*, to which he assigned three species found in California and one in Guatemala but which are now assigned to *Plutellus* (Eisen, 1894 and 1900). Michaelsen (1921) described *P. sierrae* from California.

The species of *Plutellus* here described from Oregon are associated with species of *Megascolides*, and representatives of both of these genera are also found in Australia, Tasmania, and India.

Important characters of the genus *Plutellus* as given by Stephenson (1930, p. 833) are: "Setae eight per segment. Male pores paired or single; female pores mostly paired; spermathecal pores end at furrow 8/9 or on segment ix, a single pair, or a series of two to five

pairs, or five single pores. A gizzard in the region of segments v–vii. Purely meganephridial. Prostates tubular, with simple unbranched canal."

PLUTELLUS GARLOUGHI, new species

Distinguishing characters.—Length of preserved specimens, not strongly contracted, averages about 115 mm. Diameter, approximately 4 mm. Average number of somites, about 166. Setae are widely paired, approximately $aa:ab:bc:cd=5:2:3:3$, anterior to the clitellum. Penial setae long, slender, curved in sagittal plane with convex side anteriad; length about 1 mm and diameter slightly less than 0.02 mm. Clitellum 13–18, much thinner on midventral part. Ventral median papilla, small and circular on 10/11; occasionally on 9/10 or 11/12, and 15/16. Paired transversely elongate papillae on 19/20 and in some specimens on one or more following somites. Male pores on 18 in seta line *b* and closely approximated to penial setae. Oviducal pores on 14, about midway between seta line *a* and the midventral line. Spermathecal pores at 7/8 and 8/9 in seta line *b*. Calciferous gland of simpler type, includes posterior part of 9 and extends to middle of 15. Paired dorso-esophageal hearts seem to be lacking in thirteenth somite. Spermathecae of 8 are somewhat smaller, and the diverticulum of the duct has one chamber with ridged lining, while there are three or four such chambers in the diverticulum of each of the spermathecae of 9.

Material.—About 20 specimens were received from F. E. Garlough in March 1931 that had been collected at Multnomah, Oreg., in the preceding month. Most of them were apparently not much contracted, and several had the reproductive organs fairly well developed. Transverse sections were prepared from one-half of the anterior 19 somites of the holotype (U.S.N.M. no. 20249) and sagittal sections from one-half of the anterior 19 somites of the paratype.

External characters.—No definite pigmentation is obvious in the preserved specimens. The length of 11 apparently complete ones that were measured is 105–125 mm, and that of the type specimen is 113 mm. The diameter is approximately 4 mm, a little less posteriorly. Somites 10–12 are definitely less in diameter than adjacent ones. The number of somites is 157–176, with an average of 166, and in the type there are 167. The setae spacing is somewhat variable and anterior to the clitellum is approximately $aa:ab:bc:cd=5:2:3:3$ and posterior to the clitellum $aa:ab:bc:cd=7:3:5:4$; *dd* is about one-third of the circumference. The setae are slender and variable in length and anterior to the clitellum 0.4−0.525 mm in length. The distal part has fine sculpture, most evident near the tip. Setae *a* and *b* of 18 are long, slender penial setae, with a nearly

uniform rate of curvature in a sagittal plane with the convex side directed anteriad. The length in a sectioned specimen is about 1 mm, and the diameter midway of the length is about 0.015 mm and near the proximal end 0.017 mm. The distal part tapers gradually near the end and is finely sculptured. The distal ends protrude but very little and are very closely approximated with the male pore and near seta line *b*.

The prostomium is epilobic. The anterior five somites are biannulate, and others are triannulate. The clitellum includes 13–18. It is much thinner on the median ventral part of 13–15 and is undeveloped on 16–18 between seta lines *a*. Papillae are variable in number and locations. Ventral median papillae of small size and circular outline are found anterior to the male pores in 20 specimens. In 14 of them, including the type, such papillae are found only at 10/11. In three others such papillae are found at 10/11 and also at 15/16. In one specimen the papilla is at 9/10. In another there are papillae at 9/10 and 10/11, and in the paratype they are at 10/11 and 11/12. Posterior to the clitellum the papillae are transversely elongate and the anterior pair are at 19/20 in line with *ab*. Other pairs, when present, become progressively more approximated and are sometimes in contact at the midventral line. Each of 19 specimens has a pair on 19/20; in nine specimens there is an additional pair on 20/21; and in two there is a third pair on 21/22. In one abnormal asymmetrical specimen, in which the organs of a part of the left side are one somite anterior to the normal position, there are four pairs of papillae, of which those of the left side are at 18–21 and those of the right side at 19–22. The anterior median papilla of this specimen is at 10/11. Dorsal pores are present posterior to the clitellum, but none have been found in the anterior somites. Nephridiopores are paired on each of most somites but irregularly distributed. Some open on seta line *d* and others on seta line *c* in the region in which sections were made. Each of the pair of male pores on 18, laterad of the penial setae and closely approximated with them, is located on the summit of an elevation in seta line *b*. Oviducal pores are paired on 14 and located a little anteriad of the setae and midway between the midventral line and seta lines *a*. There are two pairs of spermathecal pores at 7/8 and 8/9 and in seta lines *b*.

Internal characters.—The most strongly thickened septa are 7/8–10/11; less thickened are 6/7 and 11/12. The dorsal wall of the pharynx is much thickened and includes an evaginated chamber with diverticula. A powerful gizzard is present in 5. The lining layer of the esophagus in the anterior part forms longitudinal folds, approximately 15 in number. In the posterior part of somite 9 there

is an increase in diameter, the number of folds is about doubled, the folds are much thinner and extend nearly to the middle of the lumen. This type of structure is continued in following somites to the middle of the fifteenth and is similar to that of the simpler type of calciferous glands in some species of *Diplocardia* and *Megascolides*. Posterior to 15 there is a marked decrease in the number and height of the folds of the lining epithelium and in the diameter of the esophagus. The enlarged intestinal region begins in 18 and a typhlosole is present.

Nephridia are paired in the second and following somites. Dorsal and ventral blood vessels are present; subneural and lateroneural vessels are lacking. Short, longitudinal vessels connected with the blood plexus of the median dorsal wall of the esophagus in 8–13 seem to be representative of a supra-esophageal vessel. Short longitudinal vessels on each side of the median ventral part of the esophagus in 8–13 seem to represent a pair of subesophageal or laterolongitudinal vessels. Paired dorsal hearts are present in 7–9, and paired dorso-esophageal hearts are present in 10–12. No trace of hearts was found in the thirteenth somite of either of the sectioned specimens.

Spermaries and spermiducal funnels are paired in 10 and 11, and the sperm ducts of either side unite in 13 and form a single duct, which unites with the prostate gland in 18. The exact place of union with the gland could not be determined in either series of sections. Paired sperm sacs in 11 and 12 communicate with 10 and 11, respectively, near the esophagus. A pair of prostate glands is present in 18. The glandular part is long and contorted and of the tubular type. The muscular duct of each is shorter, of smaller diameter, and also contorted. Ovaries and oviducal funnels are paired in 13 and oviducts in 14. No ovisacs were found. Paired spermathecae are present in 8 and 9, those of 9 being largest. The ampullae have moderately thin walls, and the lining layer has numerous low ridges. The ducts are short and have thick walls, and the lining layer forms several ridges. A short diverticulum with one chamber having a ridged lining is developed on the anterior wall of each of the ducts in 8, and in a similar position a short diverticulum with three or four chambers is formed on the wall of each of the ducts in the ninth somite.

PLUTELLUS OREGONENSIS, new species

Distinguishing characters.—Length of strongly contracted specimens, approximately 50 mm. Diameter, about 4 mm. Average number of somites in five specimens is 117. Setae are widely paired, with spacing in anterior region approximately $aa:ab:bc:cd=$

6 or 7:3:5:5; *dd* about one-third of circumference. Penial setae long, slender, curved in longitudinal plane with distal end finely sculptured and protruding but little. Length approximately 0.9 mm and maximum diameter slightly less than 0.03 mm. Clitellum includes 13–18 and much thinner in midventral part. Transverse median papilla on 9/10 between seta lines *b*. Paired transverse papillae on 19/20 in line with ventral setae. Male pores on 18, in seta line *b* and close to penial setae. Oviducal pores nearer to midventral line than to seta line. Spermathecal pores at 7/8 and 8/9 in seta line *b*. Calciferous gland much more highly developed in 15 and 16 than elsewhere. Sperm ducts of either side unite in 12, and the ducts thus formed enter the prostate ducts near their connection with the prostate glands. Spermathecae of 9 somewhat larger but otherwise similar to those of 8.

Material.—Six specimens were received from F. E. Garlough in March 1931 that had been collected in the preceding month at Multnomah, Oreg. They were all strongly contracted and most of them in a state of sexual inactivity. Sagittal sections from one-half of the anterior part of the holotype (U.S.N.M. no. 20247) and transverse sections of the other half were prepared.

External characters.—The average length of four specimens is about 49 mm and that of the type 53 mm. The diameter is about 4 mm in most of the specimens, and there is no noticeable contraction anywhere, other than near the extremities. The number of somites in five apparently entire specimens is 108–124, with an average of 117, and in the type there are 124. The setae are widely paired and the spacing anteriorly about *aa*:*ab*:*bc*:*cd*=6 or 7:3:5:5; *dd* is about one-third of the circumference; *ab* is somewhat less in the clitellar region and *aa* correspondingly greater. The penial setae are long, slender, and curved in a plane nearly longitudinal, with the convex side anteriad. The rate of curvature is a little more pronounced near either end than in the middle, but is nowhere very abrupt. The distal ends of the setae are finely sculptured with transverse ridges, which are most definite on the penial setae. The length of the penial setae is slightly more than 0.9 mm, and the diameter near the proximal end is slightly less than 0.03 mm and still less toward the distal end. The distal ends protrude but little and are closely approximated to each other and to the male pores.

The prostomium is small and epilobic. Posterior to 6 the somites are triannulate. The clitellum includes 13–18 and on the midventral side of 14–16 is much thinner than dorsally and is still less developed on the ventral side posterior to 16. A transversely elongate, median, ventral papilla on 9/10 and extending on each side to seta line *b* is present on the type and on each of most of the other specimens.

A pair of transversely elongate papillae is present on the type and on some other specimens at 19/20, in line with the ventral setae, but none were found elsewhere. No dorsal pores were found in the anterior 18 somites, and in the others they were very inconspicuous. Nephridiopores are present in the second and following somites. There are two in each somite at the anterior margins, but they are irregularly distributed. Those of the first few somites are in seta line *d*, while in other somites they may be located in either of seta lines *b*, *c*, or *d*, or between lines *b* and *c*. Male pores are paired on 18 slightly laterad of the closely associated apertures of the penial setae and with them are borne on the summits of two slight elevations forming the lateral borders of a transverse depression of the ventral surface of the somite. The pair of oviducal pores on 14 are slightly anterior to the ventral setae and nearer to the midventral line than to the seta line *a*. The two pairs of spermathecal pores are at 7/8 and 8/9 in seta line *b*.

Internal characters.—Septa 8/9–11/12 are most strongly thickened, and those of 12/13 and 13/14 are but slightly thickened. The dorsal wall of the pharynx has a thickened muscular wall with an evaginated chamber that opens into the lumen of the pharynx. There is a powerful gizzard in 5 that occupies considerable space gained by pushing back the septa of a few following somites. The chief development of calciferous gland structure is in 15 and 16 in which the esophagus is much enlarged; the folds of the lining layer are much more numerous and much wider than elsewhere, and the wall is more extensively supplied with large blood vessels. There is also a definite tendency for edges of the folds to unite in some places and thus partially form a secondary lumen. In 17 there is a marked decrease in the number and width of the folds and in the diameter of the esophagus. In the posterior part of 18 and 19 there is an increase in the diameter of the alimentary tract and lumen and the beginning of the intestinal region with a definite typhlosole present. Nephridia are paired in the second and following somites, and the pores are inconspicuous and irregularly distributed. Paired dorsal hearts are present in 7–9, and paired dorso-esophageal hearts in 10–13.

Spermaries and spermiducal funnels are present in 10 and 11, and the sperm ducts of either side unite in 12 and form a single duct, which unites with the prostate duct quite near its union with the gland. Paired sperm sacs in 11 and 12 open into 10 and 11 through the septa 10/11 and 11/12 very near the esophagus. Prostate glands are paired in 18. The glandular part is long, contorted, and of the tubular type. The muscular duct is shorter and also contorted. Ovaries and oviducal funnels are paired in 13 and oviducts in 14. Ovisacs not found. Spermathecae are paired in 8 and 9; those of

9 are somewhat larger, but otherwise they are similar. The ducts are short with thick muscular walls and one or two short diverticula containing chambers having folds in the inner layer and a lumen opening into the duct. The ampullae are large and with rather thin walls.

PLUTELLUS OREGONENSIS SWIFTAE, new subspecies

Distinguishing characters.—Length of preserved specimens, not strongly contracted, 60–77 mm. Diameter, 2.5–3.5 mm. Number of somites, 116 in each of two specimens. Setae are widely paired; anterior to the clitellum approximately $aa:ab:bc:cd=4:1:3:3$; dd about one-third of circumference. Penial setae similar to those of the typical form in dimensions, form, and location. Transversely elongate papillae on 7/8, 8/9, and 9/10 and extending laterally to seta lines *a*. Normally, apparently one pair of papillae on 19/20. (Asymmetrical in type specimen.) In 15 and 16 a calciferous gland enlargement is present; numerous wide folds extending nearly to the middle of the lumen, but less highly developed than in the typical form. Nephridia, circulatory, and reproductive organs similar to those of the typical form.

Material.—The description is based on two specimens collected by F. M. McElfresh in April 1901 in the bottomlands of Marys River in the Cascade Mountains and sent by him to the writer. Only one of the specimens, the holotype (U.S.N.M. No. 20248), was sexually mature, and the anterior 24 somites of this were divided in the median sagittal plane and sagittal sections were made from one half and transverse sections from the other half. This form is similar to *P. oregonensis* in so many respects that it seems desirable to treat them as subspecies of the same species, and the selection of the other one as the typical form is due chiefly to the fact that a greater number of specimens of that form were available for study. The more important differences noticed are in the number and location of the genital papillae.

The two specimens were less contracted than those of the typical form, probably as a result of different methods of preservation. Length of type, 77 mm; diameter, 3–3.5 mm. Other specimen, 60 by 2.5–3 mm. Each specimen has 116 somites. Triannulate somites begin at the eighth. The clitellum on 13–18 is complete on 14–16, with the ventral part about one-third as thick as on the dorsal side. Ventral median papillae are present on 7/8, 8/9, and 9/10 and extend laterally to seta lines *a*. Paired papillae posterior to the clitellum are asymmetrical in the specimen studied, being at 19/20 on the left side and at 20/21 on the right side. Anterior to the clitellum approximately $aa:ab:bc:cd=5:2:4:4$ and posterior to the clitellum $aa:ab:bc:cd=4:1:3:3$; dd is about one-third of the circumference.

Holotype.—U.S.N.M. no. 20248.

Remarks.—The subspecies is named in recognition of Miss Lola Swift, graduate student at the University of Illinois in 1917, who made a careful study of it and contributed some of the data used.

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